

Modeling Landowner Participation in a Proposed Reforestation Loan Program

Kathryn G. Arano
Division of Forestry, West Virginia University
322 Percival Hall, P.O. Box 6125
Morgantown, WV 26506-6125

Ian A. Munn, John E. Gunter and Steven H. Bullard
Department of Forestry, Forest and Wildlife Research Center
Mississippi State University
Box 9681, Mississippi State, MS 39762

Max L. Doolittle
Social Science Research Center, Mississippi State University
Box 5287, Mississippi State, MS 39762

The absence of available credit to finance reforestation investments among NIPF landowners has been one of the contributing reasons why landowners do not reforest after harvest. Financial assistance programs are therefore a solution to initiating reforestation investments. However, previous studies indicate many landowners are not actively participating in existing government assistance programs. This paper examines reforestation loans as an alternative financial assistance program. Landowner participation in a proposed reforestation loan program is modeled using logistic regression. Results indicate that landowner participation in the program is influenced by ownership size, socio-demographic characteristics, and availability of other forestry incentive and assistance programs.

Keywords: reforestation loan program, non-industrial private forest (NIPF) landowners, financial assistance, logistic regression, Mississippi

INTRODUCTION

Prompt reforestation of cutover timberlands and aforestation of marginal agricultural lands provide economic and environmental benefits. Because non-industrial private forest (NIPF) landowners account for the majority of timberland ownership in the USA, encouraging NIPF landowner investment in timber production is important. Government assistance programs aiming to assist landowners with timberland investment fall into three categories: technical, educational, and financial. These are important tools in encouraging private landowners to invest in reforestation and aforestation. Financial incentives are created to address high reforestation costs, one of the main reasons why landowners fail to reforest. Historically, the government

has concentrated its efforts on providing financial incentives to encourage changes in existing land practices (Bell *et al.* 1994). The main types of financial incentives currently available to NIPF landowners include cost-share funds, reforestation tax credits and amortisation of expenses associated with reforestation (Royer and Moulton 1987 and Bullard and Straka 1988). These programs usually provide assistance to landowners to encourage tree planting.

Availability of capital and landowner's willingness to invest are necessary to initiate forestry investments (Nodine 1993). The absence of available credit to finance the high cost of reforestation investments is often cited as a reason for not reforesting (e.g. Provencher 1990 and Gunter *et al.* 2001a). Despite the presence of federal and state financial assistance programs, participation of NIPF landowners is not widespread. For instance, Royer and Moulton (1987) reported that government programs providing reforestation tax incentives and cost sharing have a positive influence on reforestation but are not widely used by NIPF landowners in the southern USA. It is therefore imperative to examine which programs or combinations of programs are necessary and whether new programs should be created. The lack of participation by landowners in these existing programs or lack of landowner investment in general suggests a need for continued development of innovative investment mechanisms that cater to the needs of landowners and, at the same time, take into account the long-term interest of the southern timber resource base (Provencher 1990). Programs should be designed so as to obtain the greatest response possible from forest landowners (Webster and Stoltenberg 1959). Such programs could be designed more effectively if designers could predict how owners in a particular area would respond to these programs.

In light of the lack of response of landowners to existing financial assistance programs (e.g. cost-share programs), Provencher (1990) proposed an alternative investment mechanism to increase reforestation rates among landowners: a loan program. While cost-share programs provide financial assistance to landowners by covering only a particular percentage of the total reforestation costs, loan programs could cover the entire cost of reforestation. The establishment of a forestry investment loan program could substantially increase long-run timber supply and reduce the budget deficit by: (a) replacing cost-share programs; and (b) generating income from profitable investments (Provencher 1990). Under this program, the government provides a loan to a landowner to cover all costs of a particular forestry investment, such as reforestation. The landowner repays the loan or part of it when the timber is harvested. The PEER Committee (1998) proposed a similar alternative to encourage reforestation investments among Mississippi NIPF landowners. The question, however, is whether such an alternative program will be acceptable to these landowners.

This study looks at the proposed PEER reforestation loan program, as an example of possible government-backed reforestation loan programs, and examines how landowners might respond to it. Gunter *et al.* (2001b) presented preliminary statistics on the response of landowners to such program. They also identified possible reasons for not wanting to participate, which included not wanting to be in debt and not wanting to use the land as collateral for the loan. In this study, landowner behavior towards such a program was modeled to identify factors that influence participation in the loan program. The decision to participate or not to participate in the program is dictated by landowner's utility maximising behavior.

Because of the uncertainties surrounding a landowner's decision-making process – e.g. unobserved alternatives, unobserved individual attributes, measurement errors (Manski 1977) – a random utility model (RUM) has been used to determine the probability of landowner participation in the proposed reforestation loan program. Modeling landowner behavior regarding such a hypothetical program will provide important insight for designing programs to encourage timberland investment. Such information is necessary to determine if new programs are needed to encourage landowners to invest in timber production or if modifications are needed for existing programs. The following sections present the research methodology used, including the theoretical and empirical models employed. The results of the empirical model are then discussed and implications are drawn regarding landowner participation towards the reforestation loan program.

SURVEY METHOD

The data used in this study were obtained by a telephone survey of Mississippi NIPF landowners conducted by the Social Science Research Center (SSRC) between March 15 and May 30, 2000. The sampling frame was limited to landowners who harvested timber between January 1994 and December 1998 and those who owned at least 8 ha of uncultivated land. The 8-ha threshold was chosen to eliminate non-forestry uses (e.g. home sites). Landowners who own less than 8 ha account for only 8.5% of the state's uncultivated lands (Doolittle 1996). While the response of landowners who did not harvest during this period may provide useful information, they were not included in the sample because the data were initially collected to provide information only on regeneration efforts of landowners who recently harvested timber. This specialised nature of the sample should be taken into account when interpreting the survey results. Landowners living in the Mississippi Delta counties were also excluded either because timberlands in these areas were mostly hardwoods or because landowner records were not available at the time of the survey.

The sample size was designed to achieve a 5% sampling error at a 95% confidence level. A simple random sample of approximately 22% of landowners from 62 of the state's 82 counties was included in the survey sample. However, it should be noted that the survey was initially designed to have approximately the same number of regenerators and non-regenerators in the sample. Thus, the final sample used in the study resulted in two distinct groups: regenerators and non-regenerators. A modified Dillman's (1978) Total Design Method for survey procedures was used in conducting the survey. A total of 7,392 of landowners were contacted in the survey but the majority (6,223) did not meet the criteria for tract size and harvest activity. Moreover, 340 of those contacted refused to be interviewed. Thus, only 829 respondents (427 regenerators and 402 non-regenerators) completed the interview.

The survey instrument sought information about ownership characteristics, which include size of holding and ownership type; socio-demographic characteristics of respondents (income, age, education, gender, race, and place of residence); and landowner participation in other assistance/incentive and educational programs. Landowner responses to the proposed reforestation loan program were solicited by

asking the following question:

‘Suppose the State of Mississippi would loan you money at a competitive rate of interest (e.g., 7.0 – 7.5%) and you would not have to repay the loan until the trees are harvested, and you had to put up the reforested land as collateral for the loan; would you be interested in borrowing the money to pay the total cost of reforesting the tract, assuming it would be profitable in the long term?’

Landowners were also told that the proposed loan program could only be used in conjunction with the Mississippi Reforestation Tax Credit. Thus, the loan program would serve as a substitute to other existing financial assistance programs (e.g. cost-share programs).

Landowners will also be required to pay a one-time, up-front insurance premium to cover losses to seedling mortality, fire, wind and ice storms, insects and diseases, and theft, through a self-insurance program that will be administered by the State of Mississippi. This insurance cost would be added to the reforestation loan.

MODEL AND VARIABLE DEFINITIONS

A random utility model (RUM) was used to determine factors influencing landowner participation towards the proposed reforestation loan program. Factors evaluated in the model draw upon the theoretical discussions presented by Webster and Stoltenberg (1959). Landowner characteristics including occupation, age, method by which forest property was acquired, years owned, distance of forest property from owner’s residence, acreage of ownership, and value per hectare of standing timber are some of the factors that are known to be closely correlated with owner responsiveness to various types of forestry programs. Previous work also showed that income, program cost, and landowners’ previous experience and knowledge about existing incentive/assistance programs are important determinants of participation (Esseks and Kraft 1988, Bell *et al.* 1994 and Stevens *et al.* 1999). Evaluating these factors is important in determining the responsiveness of landowners to new programs. Thus, the utility model for landowner participation in a government assistance/incentive program is:

$$U_i = \beta_1 C + \beta_2 D + \beta_3 O + \beta_4 P + \varepsilon \quad \text{Equation 1}$$

where U_i is the utility received by a landowner from participating or not participating in the government assistance/incentive program; C is the cost associated with participating in the program; D is a vector of landowner characteristics; O represents a vector of ownership characteristics; P measures the influence of existing incentive/assistance programs; β_1 , β_2 , β_3 , and β_4 are the model parameters; and ε is random error. Assuming that the error terms are independent and identically Gumbel distributed, the model can be estimated as a binary logistic model (Ben-Akiva and Lerman 1985).

The empirical model in this study is specified as:

$$\text{LOAN} = \beta_0 + \beta_1\text{INC1} + \beta_2\text{INC2} + \beta_3\text{INC3} + \beta_4\text{AGE} + \beta_5\text{HSED} + \beta_6\text{COED} + \beta_7\text{RACE} + \beta_8\text{SEX} + \beta_9\text{RESI} + \beta_{10}\text{LNACRE} + \beta_{11}\text{TYPE} + \beta_{12}\text{EDPR} + \beta_{13}\text{AWARE} + \beta_{14}\text{INDUS} + \varepsilon$$

Equation 2

where β s and ε are the model coefficients and error term, respectively. The dependent variable (LOAN) was measured by the observable choice of whether landowners will participate in the loan program. The response for this variable was dichotomous. “Yes” responses were coded as “1” and “no” responses were coded as “0.”

Previous studies have shown that landowner characteristics are associated with landowner decisions concerning the management of their timberlands (Greene and Blatner 1986, Romm *et al.* 1987 and Bliss and Martin 1989) and landowner participation in government assistance/incentive programs (Bell *et al.* 1994, Lorenzo and Beard 1996 and Mills *et al.* 1996). Landowner characteristics provide a measure of preferences and resources of NIPF landowners (Beach *et al.* 2002). A vector of landowner characteristics was included in the model to account for the influence of such characteristics on participation in the proposed loan program. Six demographic characteristics were included in the model to represent the vector of landowner characteristics (D): income, age, educational level, race, gender, and place of residence.

Income is represented by four income categories: (1) landowners earning under \$30,000 annually (INC1); (2) landowners earning between \$30,000 and \$60,000 (INC2); (3) landowners earning between \$60,000 and \$90,000 (INC3); and (4) landowners earning over \$90,000 (INC4). The variable INC4 was dropped from the model to allow for the inversion of the X'X matrix. Because of the cost associated with the loan, lower income categories are hypothesised to be associated with lower probabilities of participation.

Age (AGE) is hypothesised to be negatively related to landowner's participation. Older landowners are expected to be less likely to participate in the program because of the loan length.

Educational level measures a landowner's highest educational attainment and is represented by three categorical variables: (1) landowners with at least a high school or less than high school education (HSED); (2) landowners with at least a college degree (COED); and (3) landowners with advanced degrees (ADED). Again, for computational purposes, the last category was dropped from the model. Higher educational level is hypothesised to be associated with higher probabilities of participation in the program. Landowners with higher level of education will more likely understand how the program will work and will therefore have a better grasp of its potential benefits.

RACE and SEX are both categorical variables representing landowner's race and gender, respectively. Previous studies have reported that participants of government programs have been predominantly male and white (e.g. Esseks and Moulton 2000 and Sullivan *et al.* 2002). It is also hypothesised that males and whites will be more likely willing to participate than females and blacks/nonwhites.

Place of residence (RESI) is a dummy variable that describes where respondents reside: farm/town (population is <10,000) or city (population is >10,000).

Landowners residing in farms/towns are expected to be more willing to participate than others since timberland properties are more likely located in these areas. Studies have shown that landowners residing on their timberland property are more involved in the management of their land (e.g. Green and Blatner 1986, Jamnick and Beckett 1987 and Mills *et al.* 1996).

The nature of landholdings will likely influence landowner decisions to participate in a program. Bell *et al.* (1994) identified farm features like size and ownership type as factors that may contribute to participation in an incentive/assistance program. To account for the influence of the nature of landholdings on participation, a vector of ownership characteristics was included in the model. The vector of ownership characteristics (O) is represented by two variables, ownership size and ownership type. Ownership size (LNSIZE) is the size of landowner holdings in hectares, which is expressed as the natural logarithm of hectares owned. Ownership size is expected to have a positive influence on the decision to participate. Ownership type (TYPE) is a dummy variable describing the nature of timberland ownership (e.g. sole ownership, corporation). It is expected that simpler ownership types (e.g. sole ownership) are more likely to be associated with participation than larger corporations because the former are more likely to have less financial resources.

Availability of other assistance/incentive programs is assumed to influence the landowner's probability of participation in the proposed loan program. A landowner's previous experience with existing assistance/incentive programs or their awareness about these programs will have a bearing on their decision to participate. Previous work has shown that landowners who have experience with other programs or those who have knowledge about them are more likely to participate in a new program (Esseks and Kraft 1988, Esseks and Kraft 1989 and Bell *et al.* 1994). To account for the influence of these other programs, three variables were used in the empirical model: (1) number of educational programs attended by landowners (EDPR), (2) landowners' knowledge or awareness (AWARE) of the different government incentive programs available to them (e.g. Forestry Incentive Program, Reforestation Tax Credit), and (3) landowner participation in landowner assistance programs sponsored by forest industry (INDUS). These variables are also hypothesised to positively influence participation in the loan program.

No cost variable was included in the empirical model because the only out-of-pocket cost landowners will face is a small fee for loan administration. The reforestation loan will fund 100% of the cost of reforestation and a one-time, up-front insurance premium. The cost of borrowing money per hectare of reforested timberland is the same for all landowners. A summary of the definitions and coding of the variables are presented in Table 1.

Table 1. Definitions and coding of the independent variables used in the logistic regression model.

Variable name	Definition and codes
INC1	Annual household income, dummy variable Coded 1 = < \$30,000; 0 = otherwise
INC2	Annual household income, dummy variable Coded 1 = between \$30,000 and \$60,000; 0 = otherwise
INC3	Annual household income, dummy variable Coded 1 = between \$60,000 and \$90,000; 0 = otherwise
INC4	Annual household income, dummy variable Coded 1 = >\$90,000; 0 = otherwise
AGE	Age in years
HSED	High school education, dummy variable Coded 1 = with at least high school or less than high school education; 0 = otherwise
COED	College education, dummy variable Coded 1 = with at least a college degree; 0 = otherwise
ADED	Advanced education, dummy variable Coded 1 = with advanced degrees; 0 = otherwise
RACE	Race, dummy variable Coded 1 = white; 0 = black or non-whites
SEX	Gender, dummy variable Coded 1 = male; 0 = female
RESI	Place of residence, dummy variable Coded 1 = farm/town (population < 10,000); 0 = city (population > 10,000)
LNSIZE	Ownership size in hectares, natural logarithm
TYPE	Ownership type, dummy variable Coded 1 = sole ownership/co-own; 0 = partnership/corporation/estate/trust/other types
EDPR	Number of educational programs attended
AWARE	Knowledge/awareness of available government assistance/incentive programs, dummy variable Coded 1 = aware; 0 = otherwise
INDUS	Participation in assistance programs sponsored by forest industry, dummy variable Coded 1 = participated; 0 = otherwise

ESTIMATION PROCEDURES FOR THE EMPIRICAL MODEL

Since the dependent variable in the model is dichotomous, the binary logistic model was used to estimate model parameters. Logistic regression is a popular and useful technique for binary response situations. Logistic regression is based on the cumulative logistic probability function and estimates the probability of a particular action given a set of categorical characteristics (Pyndick and Rubinfeld 1981).

Thus, in logistic regression, the probabilities for each outcome are specified as:

$$\text{Prob}(Y = 1) = P_i = \frac{e^{B'_k X_i}}{1 + \sum_{k=1}^J e^{B'_k X_i}} \quad \text{Equation 3}$$

$$\text{Prob}(Y = 0) = 1 - P_i = \frac{1}{1 + \sum_{k=1}^J e^{B'_k X_i}} \quad \text{Equation 4}$$

This can be simplified as:

$$\log \frac{P_i}{1 - P_i} = \alpha + \beta_i X_i \quad \text{Equation 5}$$

where: P_i = probability that a landowner will participate in the loan program

X_i = independent variables, and

β_i = model coefficients.

Estimates for the parameters were obtained using maximum likelihood estimation (MLE) procedures. Due to the nature of the sample (i.e. two groups or sub-samples), a likelihood ratio test was conducted to determine whether the sub-groups (regenerators and non-regenerators) behave differently. If the coefficient estimates for the two groups are not significantly different, then the two sub-groups can be pooled and a single model can be used instead of two separate models. LIMDEP (Greene 1995) software was used to estimate parameters and marginal effects. Summary statistics of the data used in the model are presented in Table 2.

RESULTS OF THE EMPIRICAL ANALYSIS

The likelihood ratio test indicates that the parameter estimates for the two groups (i.e. regenerators and non-regenerators) do not differ from one another ($\chi^2 = 15.7$, $df = 15$). Thus, the data were combined into a single regression analysis. Results of the logistic regression analysis are presented in Table 3. Data from 573 respondents only were used in estimating the model parameters because of missing responses to some of the key questions asked in the survey. Thirty-eight percent of respondents were interested in participating in the proposed loan program.

Overall, the regression model is statistically significant at the 1% level. The model correctly classified 66% of the observations (380 out of 573). The preponderance of the variables included in the model are statistically significant. Furthermore, at least one variable representing each of the three factors hypothesised to influence landowner participation – landowner characteristics, ownership characteristics, and experience with existing incentive/assistance programs – is statistically significant.

Table 2. Summary statistics of the demographic, ownership, and awareness characteristics of Mississippi NIPF respondents who harvested timber between 1994 and 1998 (n = 573)

Variable name	Mean	Std. Deviation ^a
LOAN	0.38	-
INC1	0.29	-
INC2	0.34	-
INC3	0.17	-
INC4	0.19	-
AGE	55.58	15.65
HSED	0.36	-
COED	0.48	-
ADED	0.15	-
RACE	0.93	-
SEX	0.80	-
LNSIZE	3.95	1.32
RESI	0.85	-
TYPE	0.96	-
EDPR	1.30	3.12
AWARE	0.67	-
INDUS	0.07	-

a. Standard deviation is not reported for categorical variables.

Variables representing four of six landowner characteristics are statistically significant with the indicated sign: INC1(-), AGE(-), RACE(-), and SEX(+). The variable INC1 is negatively related to the decision to participate, indicating that landowners in the lower income level are less likely to participate. This is consistent with a priori expectation. Specifically, landowners earning less than \$30,000 annually are less likely to avail themselves of the loan than landowners in the higher income category (i.e. more than \$90,000). INC2 and INC3, the income variables for \$30,000 to 60,000 and \$60,001 to \$90,000, respectively, are not statistically significant, which implies that the probability of participation for landowners in these income categories is not different from those earning greater than \$90,000 annually. While these other income variables are not significant, the magnitude of their coefficients decreases consistently as the income category approaches the \$90,000+ category, suggesting an income effect that progresses smoothly across all income levels.

Based on the estimated signs for AGE, RACE and SEX, the probability of participation decreases with age, blacks are more likely to participate than whites, and males are more likely to participate than females. Except for race, these results are consistent with a priori expectations. In general, these results imply that landowner socio-demographic characteristics are acceptable predictors of landowner participation in incentive/assistance programs. HSED, COED, and RESI are not statistically significant. These results indicate that education and place of residence do not influence the probability of participation in the loan program. The non-significance of the education variables is somewhat surprising considering that related studies have found education to be an important factor influencing the

decision to participate in government programs. One empirical concern was that education is often closely related with income, which possibly contributed to its lack of significance. However, no significant multicollinearity was detected among the independent variables.

Table 3. Parameter estimates of the logistic regression model used to estimate participation of Mississippi NIPF respondents (n = 573) who harvested timber between 1994 and 1998 in a proposed reforestation loan program

Variable	Estimated coefficient	Standard error	Marginal effect
Constant	-0.29	0.83	-0.67
INC1	-0.57*	0.31	-0.13
INC2	-0.36	0.26	-0.08
INC3	-0.11	0.30	-0.03
AGE	-0.02***	0.01	-0.004
HSED	0.16	0.31	0.04
COED	0.30	0.27	0.07
RACE	-0.71*	0.36	-0.17
SEX	0.56**	0.25	0.13
RESI	-0.11	0.26	-0.03
LNSIZE	0.13*	0.08	0.03
TYPE	0.33	0.47	0.08
EDPR	-0.03	0.03	-0.01
AWARE	0.35*	0.21	0.08
INDUS	0.57*	0.34	0.13

Log-likelihood ratio = -357.71

Chi-square value = 46.81, df = 14, level of significance < 0.01

Observations correctly classified = 380 (66%)

"Yes" responses 219; "No" responses 354; total no. observations = 573

Note: * Significant at $\alpha = 0.10$, ** significant at $\alpha = 0.05$; *** significant at $\alpha = 0.01$. LOAN is the dependent variable.

One of the two variables used to measure ownership characteristics, LNSIZE(+) is statistically significant and has the predicted sign. Landowners with larger timberland holdings are therefore more likely to participate in the program. Previous studies have also shown a significant and positive association between ownership size and landowner participation in government assistance and incentive programs (Lorenzo and Beard 1996 and Mills *et al.* 1996). TYPE is not statistically significant indicating that type of ownership may not influence participation.

Two of the three variables representing the influence of existing incentive/assistance programs are statistically significant and have the expected signs: AWARE (+) and INDUS (+). Thus, landowners who are aware of the existence of other programs (e.g. Forestry Incentive Program, reforestation tax credits) are more likely to consider taking out a loan for their timberland investment. Similarly, those who have had previous experience receiving some form of assistance from private entities (e.g., industry) are also more likely to participate. EDPR is not statistically significant, hence there is no statistical support for the proposition that the number of educational programs attended by landowners affects the probability of participation. However, the results indicate that, in general,

experience with existing incentive/assistance programs can positively influence landowner participation.

The sizes of the marginal effects of the statistically significant variables are such that the impacts of the independent variables are important from a practical as well as a statistical perspective. For example, blacks/non-whites are 17% more likely to participate in a loan program than whites. Men are 13% more likely to participate than females. Landowners who are aware of the different government programs and have participated in industry-sponsored landowner assistance programs are 8% and 13% more likely to participate, respectively, in a loan program than those who are neither.

DISCUSSION AND CONCLUDING COMMENTS

While there have been a number of government forestry assistance and incentive programs available to landowners, these programs have met with limited success. These programs were created with the objective of increasing reforestation and aforestation on NIPF lands by providing some form of financial incentive (e.g. cost-share programs) to help landowners defray the high capital requirement of investing in stand establishment. However, not many landowners take advantage of such opportunities, which raises the question of the usefulness of these programs to landowners. A reforestation loan program is an alternative tool that could be used to encourage landowner investment in reforestation. This study has provided some useful insights into determinants of landowner participation in a hypothetical reforestation loan program.

First, enough landowners indicated a willingness to participate to indicate that loan programs can be a viable tool to encourage reforestation. Although 38% may seem low, high participation rates are not necessary to result in substantial environmental impact. To illustrate, if only 10% of the 38% actually used the loan program to reforest land that they would have otherwise left idle, the amount reforested would increase by 4%, a noteworthy result for a single program with little cost.

Second, the results of the logistic regression can be used to target loan programs to the most receptive audiences, thereby increasing program effectiveness. For example, the mean willingness to participate of landowners who recently harvested timber is 38%; however, the willingness to participate for specific groups, particularly under-served landowners can be much higher. For example, the predicted willingness to participate for white women with above average income (\$60,001 – \$90,000) and timberland holdings (188 ha) is 44% and for relatively young (45 years old) black males, it is 68%.

Third, by identifying factors associated with landowner willingness to participate in loan programs, this study provides a starting point for understanding the reasons why some landowners are willing to participate and others are not. Future research can focus on the underlying reasons why particular groups are more or less willing to participate, e.g. why are blacks/non-whites more willing to participate than whites? The answers to these types of questions can be used to modify future loan programs to increase participation. Significant factors identified in this study and some possible explanations follow.

In this study, determinants of participation were grouped in three categories: landowner characteristics, ownership characteristics, awareness of existing incentive/assistance programs. Landowner characteristics that are important determinants of participation include income, age, race, and sex.

Landowners with relatively low incomes (i.e. less than \$30,000 annually) are less likely to take advantage of the loan than landowners with relatively high incomes (i.e. over \$90,000 annually). This general finding is consistent with previous studies, which have shown that landowners in higher income categories are more likely to participate in forestry incentive/assistance programs. This may be due to the relative cost of landowner participation. While the cost to landowners is minimal, any program cost represents a greater share of household income for low income households than higher income households. Willingness to participate in the loan program decreases with age. Two possible explanations are that 1) older landowners are less comfortable with debt due to the more restrictive attitudes regarding debt during their younger years than those generally prevalent today, and 2) older landowners may be reluctant to incur debt that, in light of rotation ages of 30+ years, are likely to fall to their heirs. Race and gender are two factors frequently identified as influencing participation in government programs and our study concurred with these findings; however, blacks/non-whites are usually less likely to participate in government programs in contrast to the findings in this study. It may be that blacks/non-whites have less access to traditional sources of financing so government alternatives are viewed more favorably.

Ownership size is one ownership characteristic identified in this study that affected landowner willingness to participate. As ownership size increases, the probability of landowners participating in the program also increases. This is consistent with findings of studies on cost-share and other incentive programs. A possible explanation is that landowners with larger ownerships can take advantage of economies of size thus making forest investments more attractive. Alternative explanations may lie in the reasons landowners acquire larger ownerships. Larger landowners typically rank financial returns as the primary reason for owning timberlands whereas smaller landowners tend to rank non-pecuniary benefits higher.

Awareness of other incentive and assistance programs is also a determinant of landowner participation. Landowners who are aware of or have had any type of experience with forestry programs are more likely to participate in the proposed loan program. Landowner awareness of these programs may help them understand different timberland investment opportunities and available alternatives.

It is extremely important to have a sound understanding of how all the above factors affect participation in this or any proposed loan program. A reforestation loan program may offer a promising alternative to landowners; however, the specifics of the loan agreement can have major impacts on its success. For example, the majority of the landowners expressed reluctance to participate in the program because the land was required as collateral for the loan. Under the terms of the program, borrowers would be required to put up the reforested land as collateral or if there is an existing first mortgage on the land, the State would take a second mortgage provided there is sufficient value remaining to provide security for the loan. These terms may discourage landowners from participating. The terms surrounding a loan program should therefore be carefully designed. For instance, alternative loan programs that do not require landowners to use their land as

collateral may be more attractive to landowners. Financial assistance programs are primarily designed to help landowners defray the high cost of investing in timber production. To be attractive to landowners, these programs should minimise landowner risk with respect to the loan. An alternative way to handle this collateral problem is to use the insured trees as collateral instead of the land. This will likely encourage greater interest in the program.

In summary, government-backed reforestation loans show promise as a policy tool to encourage reforestation. Landowner participation is influenced by socio-demographic characteristics, size of timberland ownership, and landowner awareness and participation in other incentive/assistance programs. These factors should be taken into account to ensure wider participation. This is particularly important because NIPF landowners are a diverse group and are motivated by differing incentives. Thus, it is valuable to know who these landowners are and what are the motivations for their decisions, to have a better understanding of how such a program can be designed and implemented.

REFERENCES

- Beach, R.H., Pattanayak, S.K., Yang, J., Murray, B.C. and Abt, R.C. (2002), 'Empirical studies of non-industrial private forest management: a review and synthesis', Working Paper 02_05, Research Triangle Institute, www.rti.org/pubs/rtipaper_02_05.pdf, accessed 23 July 2003.
- Bell, C.D., Roberts, R.K., English, B.C. and Park, W.M. (1994), 'A logistic analysis of participation in Tennessee's forest stewardship program', *Journal of Agricultural and Applied Economics*, 26 (2), 463-472.
- Ben-Akiva, M.E. and Lerman, S.R. (1985), *Discrete Choice Analysis: Theory and Application to Travel Demand*, MIT Press, Cambridge.
- Bliss, J.C. and Martin, F.A. (1989), 'Identifying NIPF management motivations with qualitative methods', *Forest Science*, 35 (2), 601-622.
- Bullard, S.H. and Straka, T.J. (1988), 'Structure and funding of state-level forestry cost-share programs', *Northern Journal of Applied Forestry*, 5 (2), 132-135.
- Dillman, D.A. (1978), *Mail and Telephone Surveys - The Total Design Method*, John Wiley, New York.
- Doolittle, M.L. (1996), An inventory of private landowners in Mississippi, Social Science Research Center, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Mississippi.
- Esseks, J.D. and Kraft, S.E. (1988), 'Why eligible landowners did not participate in the first four sign-ups of the conservation reserve program', *Journal of Soil and Water Conservation*, 43 (3), 251-255.
- Esseks, J.D. and Kraft, S.E. (1989), 'Marketing the conservation reserve program', *Journal of Soil and Water Conservation*, 44 (5), 425-430.
- Esseks, J.D. and Moulton, R.J. (2000), *Evaluating the forest stewardship program through a national survey of participating forest landowners*, The Center for Governmental Studies, Social Science Research Institute, DeKalb, IL: Northern Illinois University.
- Greene, J.L. and Blatner, K.A. (1986), 'Identifying woodland owner characteristics associated with timber management', *Forest Science*, 32 (1), 135-146.
- Greene, W.H. (1995), *LIMDEP Version 7.0 - User's Manual and Reference Guide*, Econometric Software Inc., New York.
- Gunter, J.E., Idassi, J. and Granskog, J.E. (2001a), *Financing investments in reforestation with government-sponsored loans: a Mississippi case study*, Forest and Wildlife Research Center Bulletin FO194, Mississippi State University, Mississippi.

- Gunter, J.E., Bullard, S.H., Doolittle, M.L. and Arano, K.G. (2001b), *Reforestation of harvested timberlands in Mississippi: behavior and attitudes of nonindustrial, private forest landowners*, Forest and Wildlife Research Center Bulletin FO172, Mississippi State University, Mississippi.
- Jamnack, M.S. and Beckett, D.R. (1987), 'A logit analysis of private woodlot owner's harvesting decisions in New Brunswick', *Canadian Journal of Forest Research*, 18 (1), 330-336.
- Lorenzo, A.B. and Beard, P. (1996), 'Factors affecting the decisions of NIPF owners to use assistance programs', in M.J. Baughman (ed.), *Proceedings of the Symposium on Nonindustrial Private Forests: Learning From Past, Prospects for Future*, University of Minnesota, St. Paul, Minnesota: pp. 264-275.
- Manski, C. (1977), 'The structure of random utility models', *Theory and Decision*, (8), pp. 229-254.
- Mills, W.L. Jr., Hoover, W.L., Vasan, S., McNamara, K.T. and Nagubadi, V. (1996), 'Factors influencing participation in public management assistance programs', in M.J. Baughman (ed.), *Proceedings of the Symposium on Nonindustrial Private Forests: Learning From Past, Prospects for Future*, University of Minnesota, St. Paul, pp. 204-213.
- Nodine, S.K. (1993), 'Reforestation delay tolerance under the Forestry Incentive Programs', *Canadian Journal of Forest Research*, 23 (3), 414-426.
- Performance Evaluation and Expenditure Review (PEER) Committee. (1998), 'A policy framework for evaluating options for further encouraging Mississippi's nonindustrial private owners of forestland to reforest', Report 374, <http://www.peer.state.ms.us/374.html>, accessed 22 July 2003.
- Provencher, B. (1990), 'A new approach to increasing timber supply from the non-industrial private forests of the South', *Land Economics*, 66 (1), 102-106.
- Pyndick, R.S. and Rubinfeld, D.L. (1981), *Econometric Models and Economic Forecasts*, 2nd Edn, McGraw-Hill, New York.
- Romm, J., Tuazon, R. and Washburn, C. (1987), 'Relating forestry investment to the characteristics of non-industrial private forestland owners in Northern California', *Forest Science*, 33 (1), 197-209.
- Royer, J.P. and Moulton, R.J. (1987), 'Reforestation incentives: tax incentives and cost-sharing in the South', *Journal of Forestry*, 85 (8), 45-47.
- Stevens, T.H., Dennis, D., Kittredge, D. and Rickenbach, M. (1999), 'Attitudes and preferences toward co-operative agreements for management of private forestlands in the north-eastern United States', *Journal of Environmental Management*, 55 (2), 81-90.
- Sullivan, J., Amacher, G.S. and Chapman, S. (2002), 'Forest banking in theory and practice: empirical results from Virginia', in G.S. Amacher and J. Sullivan (eds.), *Proceedings of the 2002 Southern Forest Economics Workshop*, Virginia Polytechnic Institute and State University, Blacksburg, VA, pp. 295-304.
- Webster, H.H. and Stoltenberg, C.H. (1959), 'What ownership characteristics are useful in predicting response to forestry programs?', *Land Economics*, 35 (3), 292-295.